REPORT

Subject: "**Evaluation of the new kiwifruit variety 'Tsechelidis' and comparison with the cultivated 'Hayward' variety'.**

Research team:

1) Stylianidis Dimitrios, Honorary Director of the Institute of Deciduous Trees of Naousa: Project design and coordination, and participation in drafting the evaluation report.
2) Sotiropoulos Thomas, associate researcher of the National Agricultural Research Foundation (N.AG.RE.F.) – Institute of Deciduous Trees of Naousa: Participation in the project design and coordination.
3) Almaliotis Dimitrios, adjunct research scientist of N.AG.RE.F. – Soil Science Institute of Thessaloniki: Sampling of leaves and fruit, interpretation of leaf and fruit results, statistical analysis and graphic illustration of all parameters and participation in drafting the evaluation report.
4) Koukourikou Magda, professor of Biology of Horticultural Plants at the School of Agriculture, Aristotle University of Thessaloniki (AUTH), and
5) Petridis Antonios, postgraduate student of Agriculture at AUTH: Measurement of resistance to pressure, pH and the soluble solids (° Brix) of the fruit and determination of vitamin C, sugars, acids and the Thiault coefficient during the fruit harvest and two months later.
6) Therios Ioannis, professor of Pomology at the School of Agriculture, AUTH: Determination of the nutritional elements in fruits.
7) Karassaridou Anna, agriculturalist of the Agricultural Cooperative of Episkopi Anthemion at the Prefecture of Imathia: Diachronic measurement of the level of soluble solids (° Brix) in the fruits until the harvest.
8) Papadopoulou Eleni, assistant professor at AUTH, Department of Agricultural Economics: Economic feasibility of kiwifruit.
9) Papas Athanasios, agriculturalist, postgraduate student at the School of Agriculture, AUTH: Estimation of the production cost.
10) Psoma Polyxeni, chemist at N.AG.RE.F. – Soil Science Institute of Thessaloniki: Foliar diagnosis and determination of the fruit's dry matter.

The orchard with the 'Tsechelidis' variety, which is under evaluation, and the cultivated 'Hayward' variety is situated in the area of Episkopi Anthemion at the Prefecture of Imathia, it is 5 years old and belongs to the producer Mr. Christos Tsechelidis. The new variety came from a large population of 'Hayward' seedlings (15,000 seedlings), followed by the selection of the specific clone by the producer. Following a molecular genetic analysis of the DNA (PCR method) of the 'Tsechelidis' genotype and the cultivated 'Hayward' variety, which was carried out by the University of Thessaly, it was concluded that the two genotypes are different because polymorphism is displayed in the case of at least eight alleles. The new clone was then grafted onto new orchard plants in order to compare them with young plants of the 'Hayward' variety. This was followed by numerous visits to the experimental kiwi orchard and during 2006 the following observations, measurements and assessments (5 repeats) were made:

1. Plant and fruit characteristics.
2. Quantitative production data (yield, number of fruits/plant and average fruit weight).
3. Level of nutritional elements in leaves and fruit.
4. Qualitative fruit characteristics (resistance to pressure, pH, soluble solids (°Brix), vitamin C, acids, sugars, Thiault coefficient and dry matter).
5. Economic feasibility – Production Cost.

Based on this information the new variety 'Tsechelidis' is evaluated as follows:

1. Plant and fruit characteristics.

The shoots grow more vigorously than the 'Hayward' variety, though there is no difference with respect to resilience against pests and diseases. The fruits are more oblong than the 'Hayward' (the ratio of fruit length/width is 1.41 and 1.24 respectively), larger in size and uniform, hence, in contrast to the 'Hayward' variety, they do not require thinning. In addition, due to the fruit's large size, any decrease that may be caused by low temperatures during the flowering season or poor pollination of the fruits, will not affect the marketability of the fruits, in contrast to the 'Hayward' variety.

2. Quantitative production data (Table 1):

Table 1. Specific quantitative production data of the two actinidia varieties and significance levels.

Parameter	*Variety*		*Significance level (P*)*
	'Tsechelidis'	*'Hayward'*	
Total number of fruits/plant:	250	279	NS
Number of marketable fruits:	249	222	NS
Rate of marketable fruits (%):	99.6	79.6	-
Total yield (kg/plant):	41.9	29.9	NS
Yield of marketable fruits (kg/plant):	41.6	25.1	**
Yield rate of marketable fruits (%):	99.3	83.9	-
Average weight of marketable fruits (g):	167.0	114.5	***
Average weight of non-marketable fruits (g):	237.0	88.8	***

*P>0.05 NS (insignificant difference), 0.01<P<0.05 *, 0.001<P<0.01 ** and P<0.001 ***

From this data it is illustrated that the 'Tsechelidis' variety is superior in terms of yield, the rate of marketable fruits (by 65.74%), the average weight of marketable (by 45.9%) and non-marketable fruits in particular (by 166.9%). Non-marketable fruits are mainly very flat ("butterflies") double fruits and also small fruits, weighing less than 70 g. From the said, it is concluded that the 'Tsechelidis' variety owes its higher yield entirely to the fruit's greater weight (Figure 1).

3. Level of nutritional elements.

Nitrogen levels in the leaves of the 'Tsechelidis' variety are significantly lower statistically (1.95%) in comparison to the 'Hayward' (2.53%), though no difference was observed regarding the other nutritional elements (Figure 2). With respect to the fruits, statistically significant differences were found between the two varieties in the skin's content in phosphorous (0.13 and 0.08%, respectively), potassium (2.35 και 1.95%, respectively), magnesium

(0.08 και 0.06%, respectively) and manganese (12.6 και 8.0 ppm, respectively), and the flesh's in nitrogen (0.76 and 0.95%, respectively), phosphorous (0.13 and 0.16%, respectively), manganese (10.3 and 6.2, respectively) and copper (6.79 and 10.51, respectively). At any rate, the lower proportion of N/Ca in the flesh of the 'Tsechelidis' fruit variety in comparison to the 'Hayward' (2.30 and 2.71, respectively) is an aspect that predisposes the 'Tsechelidis' variety to greater resilience to physiological abnormalities, particularly to the internal breakdown of the fruit (Figure 3).

4. Qualitative fruit characteristics (Tables 2 and 3).

Table 2. Specific qualitative fruit characteristics of the two actinidia varieties during the harvest and significance levels.

	Variety		
Parameter	*'Tsechelidis'*	*'Hayward'*	*Significance level (P)*
Resistance to pressure (lb/in^2):	23.0	27.0	**
Flesh pH:	3.34	3.25	*
Soluble solids (°Brix) (%):	7,30	6,70	NS
Vitamin C (mg/100g fresh weight):	79.2	37.8	***
Malic acid (g/l):	4.5	4.0	NS
Sugars (g/l):	62.8	57.2	*
Thiault[z] coefficient :	107.7	97.6	*
Dry matter (%):	15.30	15.82	NS

[z]: Sum of sugars +10 times the malic acid content of fruits

Table 3. Specific qualitative fruit characteristics of the two actinidia varieties two months after the harvest and significance levels.

	Variety		
Parameter	*'Tsechelidis'*	*'Hayward'*	*Significance level (P)*
Resistance to pressure (lb/in^2):	10.4	10.9	NS
Flesh pH:	3.32	3.41	***
Soluble solids (°Brix) (%):	13.6	13.0	NS
Vitamin C (mg/100g fresh weight):	80.2	38.3	***
Malic acid (g/l):	4.8	4.5	NS
Sugars (g/l):	84.4	80.0	NS
Thiault coefficient:	132.4	125.0	NS

Based on the fruits' soluble solids (°Brix) trend 1 month prior to harvesting of the product until the harvest date (19.10.2006) (Figure 4), and the results cited above, which are illustrated in Figures 5 and 6, the following may be concluded:

The fruits of the 'Tsechelidis' variety ripen 4-5 days earlier than the 'Hayward', which is testified by the fruits' significantly lower resistance to pressure and their slight superiority in soluble solids (°Brix) during harvest. Despite this, after two months in refrigerated storage their resistance to pressure was the same as those of the 'Hayward'. Moreover, the quality of the 'Tsechelidis' variety, as expressed by the Thiault coefficient during the fruit harvest, is significantly higher than that of the 'Hayward'. Determining the Thiault coefficient during the period that the fruits are in refrigerated storage, demonstrates the fruits' preservability; in this case, after two months, the 'Tsechelidis' variety demonstrates slightly higher levels, though the difference is not significant. It should be noted that the biological value of the

'Tsechelidis' variety is very high on account of its greater (more than double) content in vitamin C. Moreover, assessments of the organoleptic properties of the 'Tsechelidis' fruit variety that were carried out by numerous individuals, have found this variety to be superior to the 'Hayward'.

5. **Economic feasibility – Production cost**.
   The data for estimating costs are based on primary data regarding prices and the production cost of the 'Tsechelidis' and 'Hayward' varieties. Relevant production expenses are depicted in Table 4.

Table 4. Production expenses for 1,000 sq. meters of the 'Tsechelidis' and 'Hayward' varieties (€/1,000 sq. meters)

	Variety	
Production factors	*'Tsechelidis'*	*'Hayward'*
Soil expenses	100.0	100.0
Labour expenses	156.5	207.7
Capital expenses	612.5	605.2
Total production expenses	868.5	912.9

From this data and according to the yields of these varieties, the following may be concluded:

a) Production cost of the 'Tsechelidis' variety:
   Expenses/yield = 868.5 € /5,605 Kg/1,000 sq. meters = 0.15 € /Kg

b) Production cost of the 'Hayward' variety:
   Expenses/yield =912.9 € /4,000 Kg/1,000 sq. meters = 0.23 €/ Kg.

The lower production costs of the 'Tsechelidis' variety, which are mainly due to the high yield and the lower labour expenses for thinning the fruits and harvesting, on account of the fruits' large size and uniformity, increase the profit margins and provide a competitive advantage in the market against the main variety cultivated to date.

Based on the said data and the relevant observations made at the kiwifruit orchard of Mr. Christos Tsechelidis, it is concluded that the new variety 'Tsechelidis' possesses significant advantages in relation to the 'Hayward', the main variety cultivated to date, which are: Larger size and uniformity of fruit, higher rate of marketable fruits, higher yield, qualitative superiority of the fruit during the harvest (Thiault coefficient), slight precociousness of production, very high content in vitamin C and low production cost.

For all these reasons the 'Tsechelidis' variety is regarded as very important and therefore suitable for inclusion among the promoted kiwifruit varieties and introduction into the production process in order to reinforce the income of kiwifruit growers.

This new variety demonstrates specifications of a high level and is evaluated as one of the leading kiwifruit varieties globally.

The introduction of the 'Tsechelidis' variety into production will greatly upgrade the cultivation of kiwifruit in our country and will render it competitive at the international level.

Attachments: a) Figures (5)
b) Graphic illustration (1)

Thessaloniki 29-12-2006

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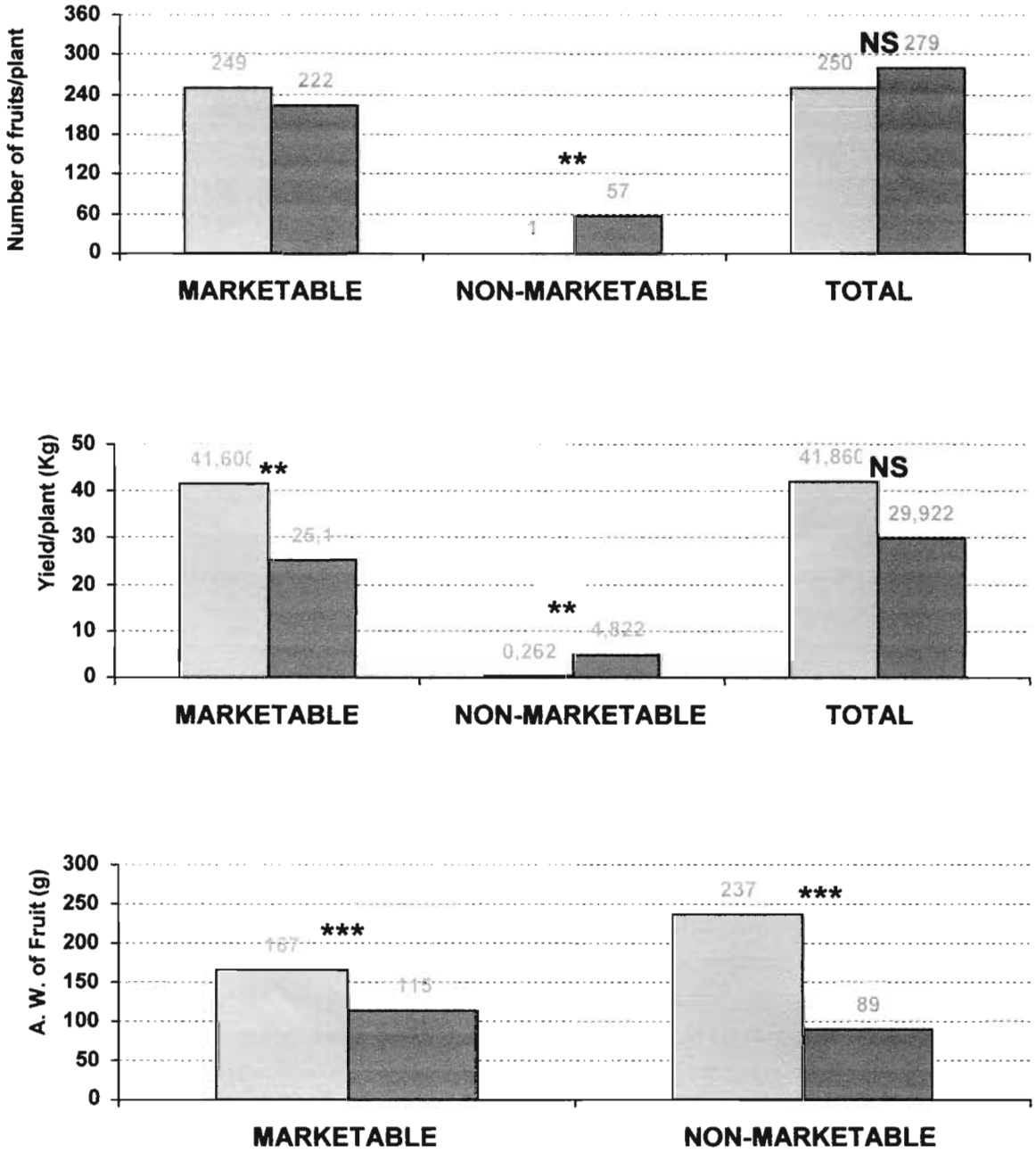

Figure 1: Number of fruits/plant, yield and average weight of marketable and non-marketable fruits of the 'Tsechelidis' and 'Hayward' actinidia varieties in 2006.

□ Tsechelidis ▨ Hayward

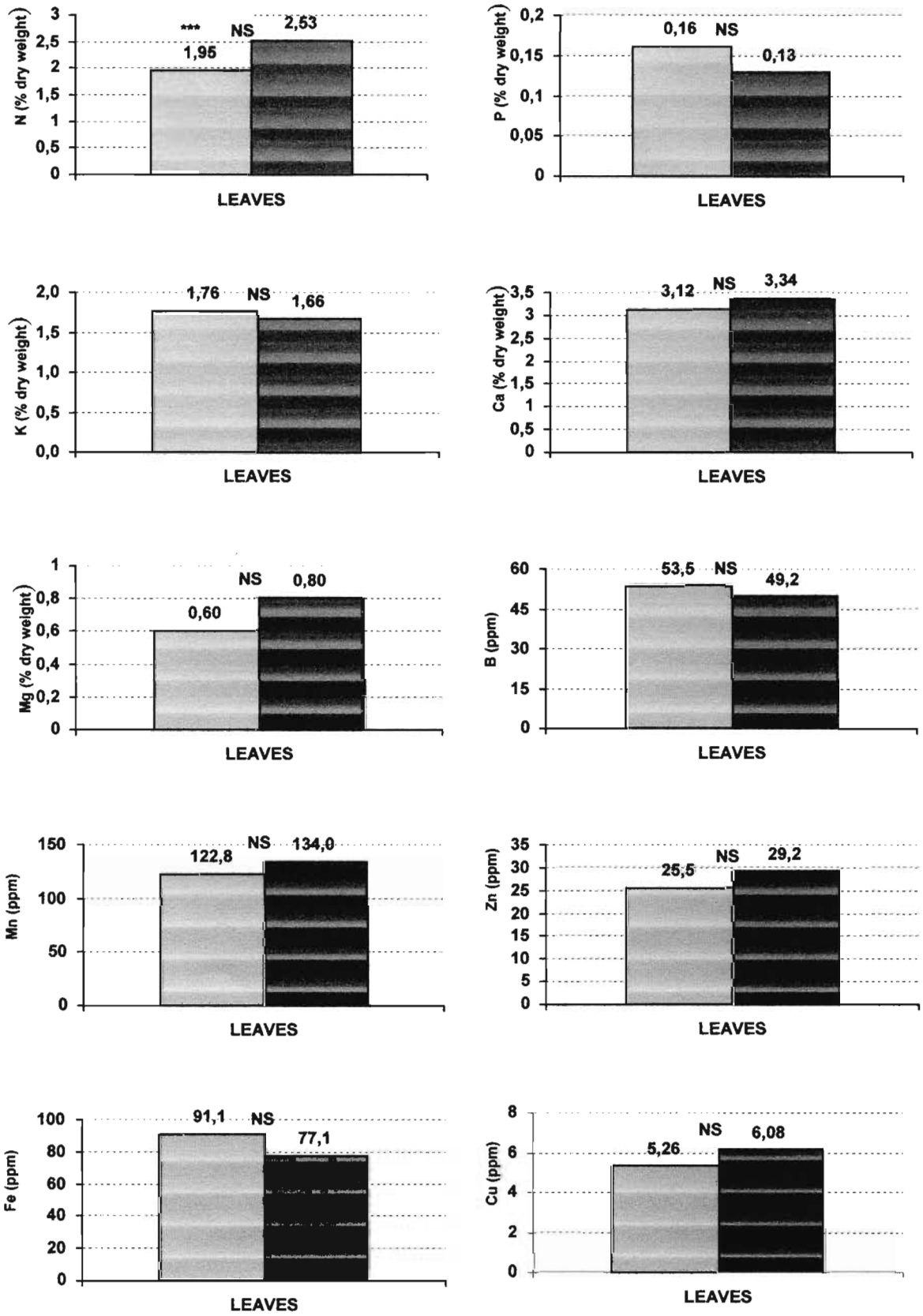

Figure 2: Content of nutritional elements in the leaves of the 'Tsechelidis' and 'Hayward' varieties in 2006.

Tsechelidis ■ Hayward

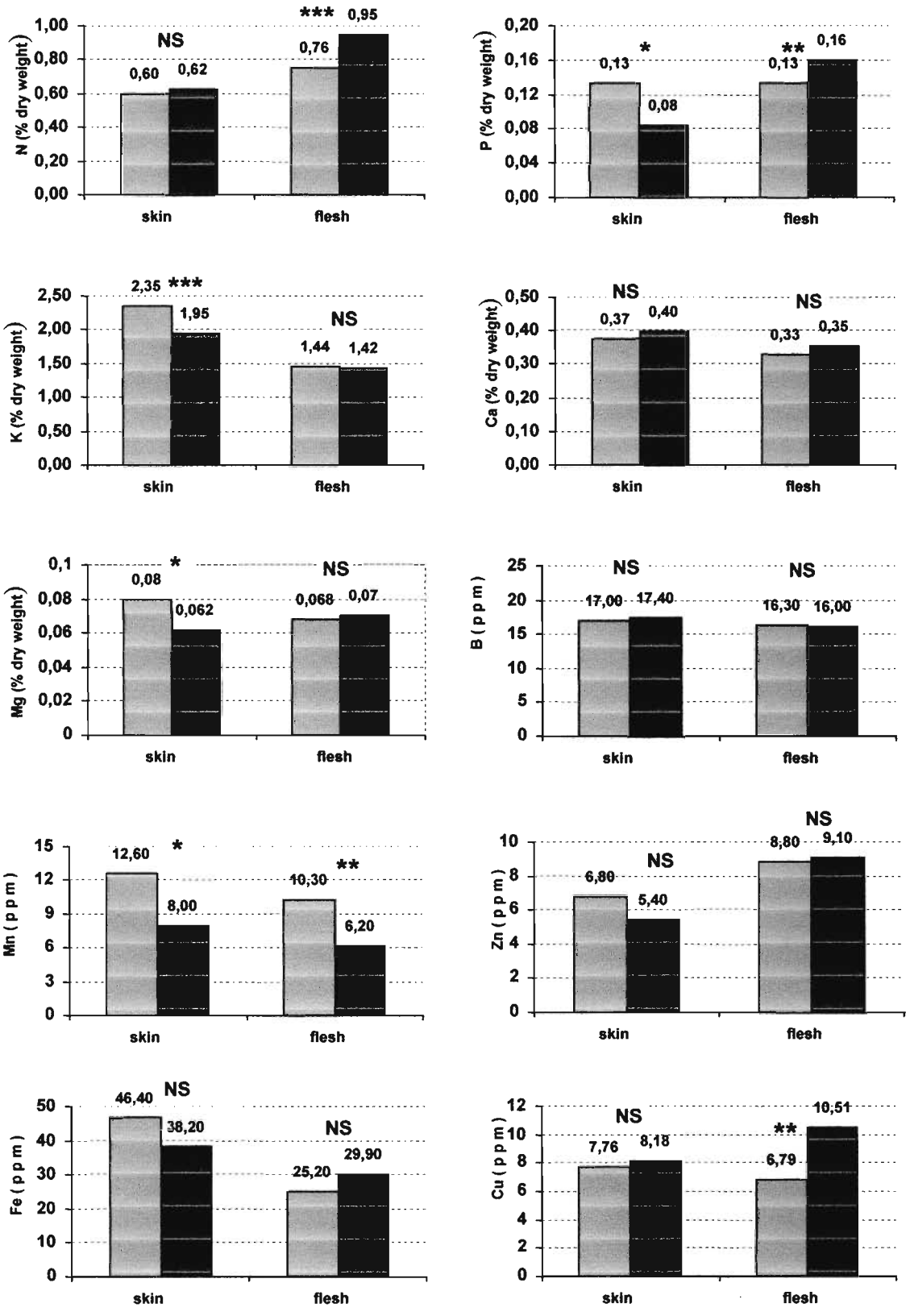

Figure 3: Content of nutritional elements in the skin and flesh of the 'Tsechelidis' and 'Hayward' actinidia varieties in 2006.

Tsechelidis Hayward

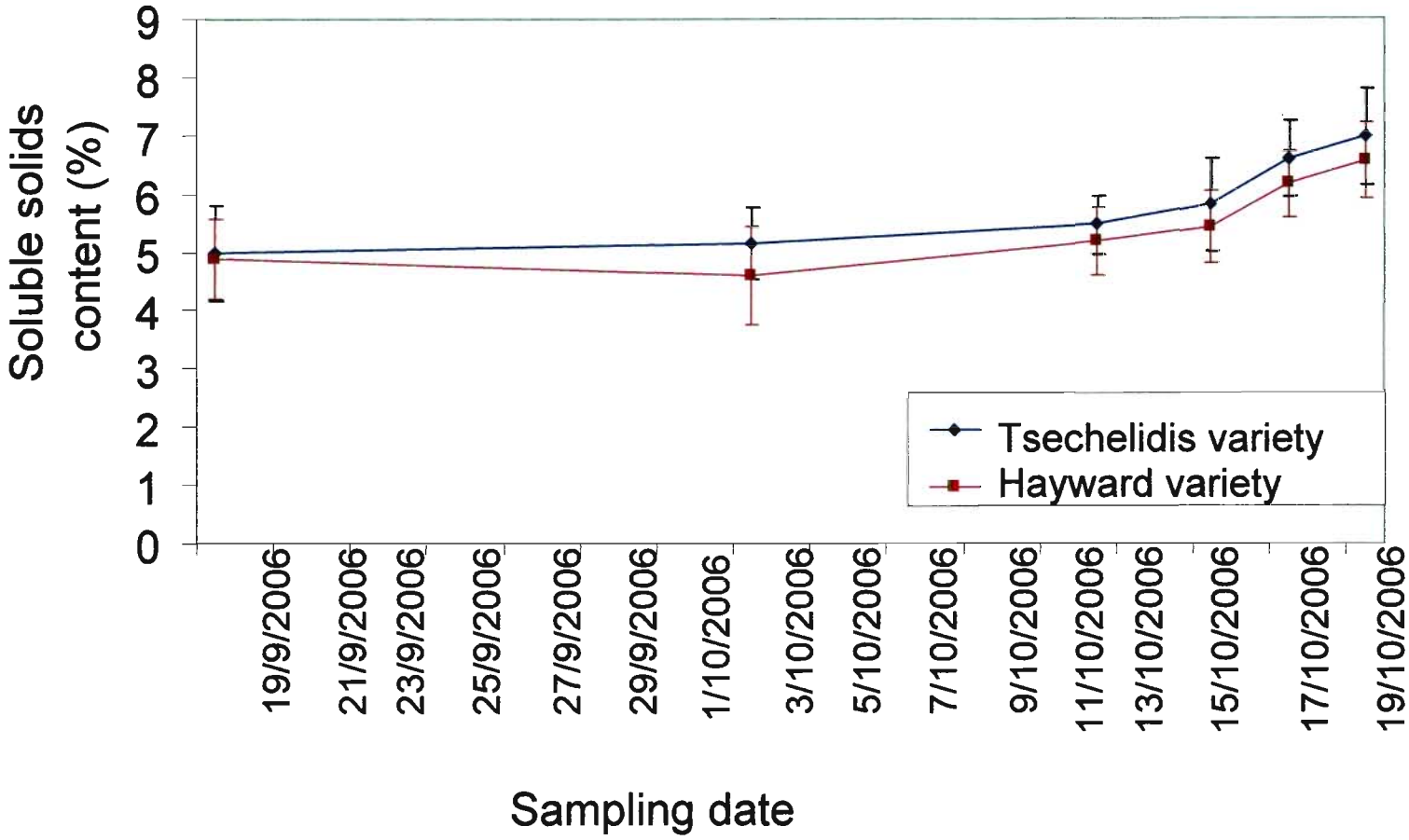

Figure 4: Trend of the value of soluble solids (°Brix) in the 'Tsechelidis' and 'Hayward' actinidia varieties from 19/9/2006 until the harvest (19/10/2006).

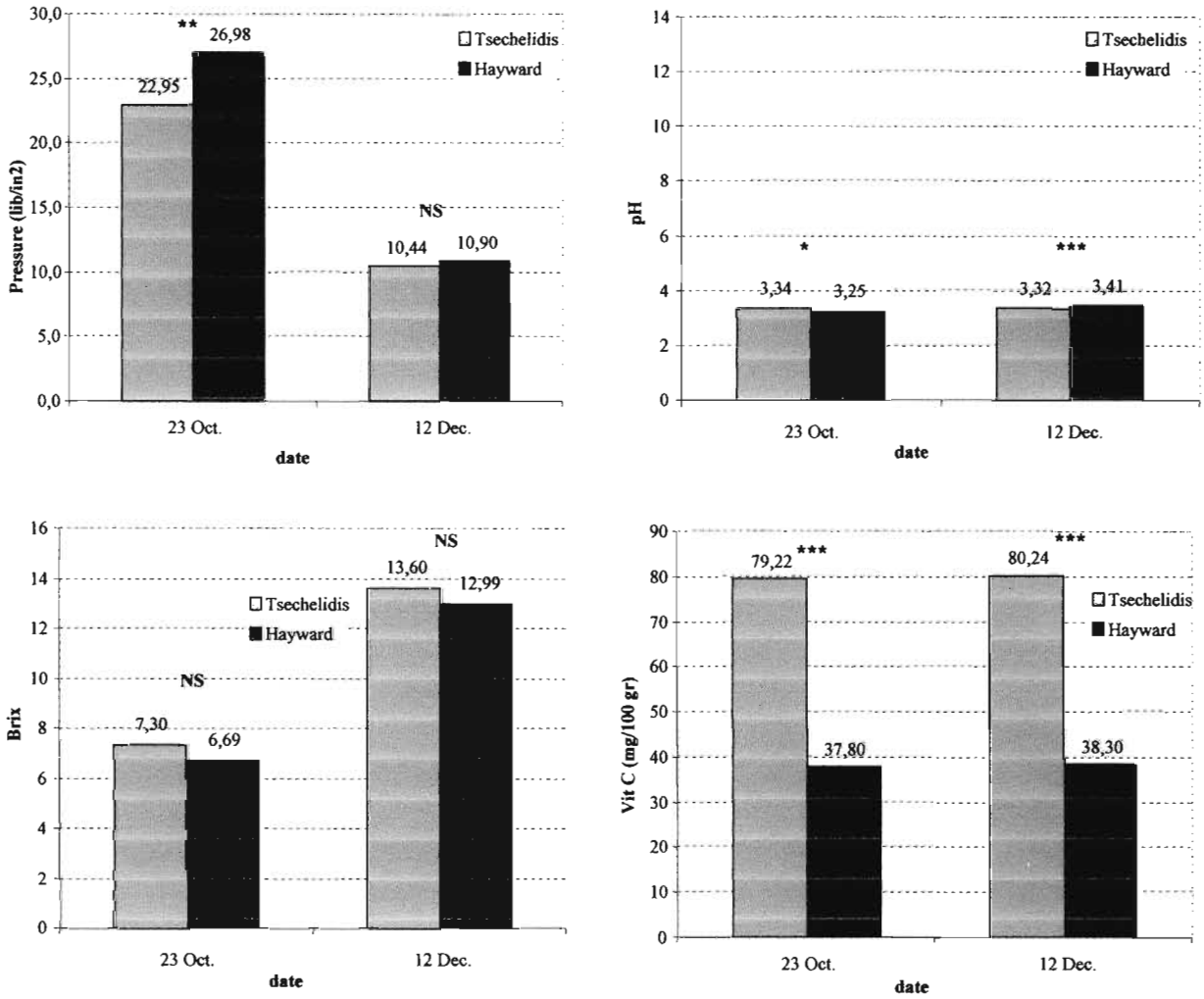

Figure 5. Resistance to pressure, pH, soluble solids (Brix), and vitamin C of the fruits of the 'Tsechelidis' and 'Hayward' actinidia varieties during the harvest and 2 months later.

Tsechelidis Hayward

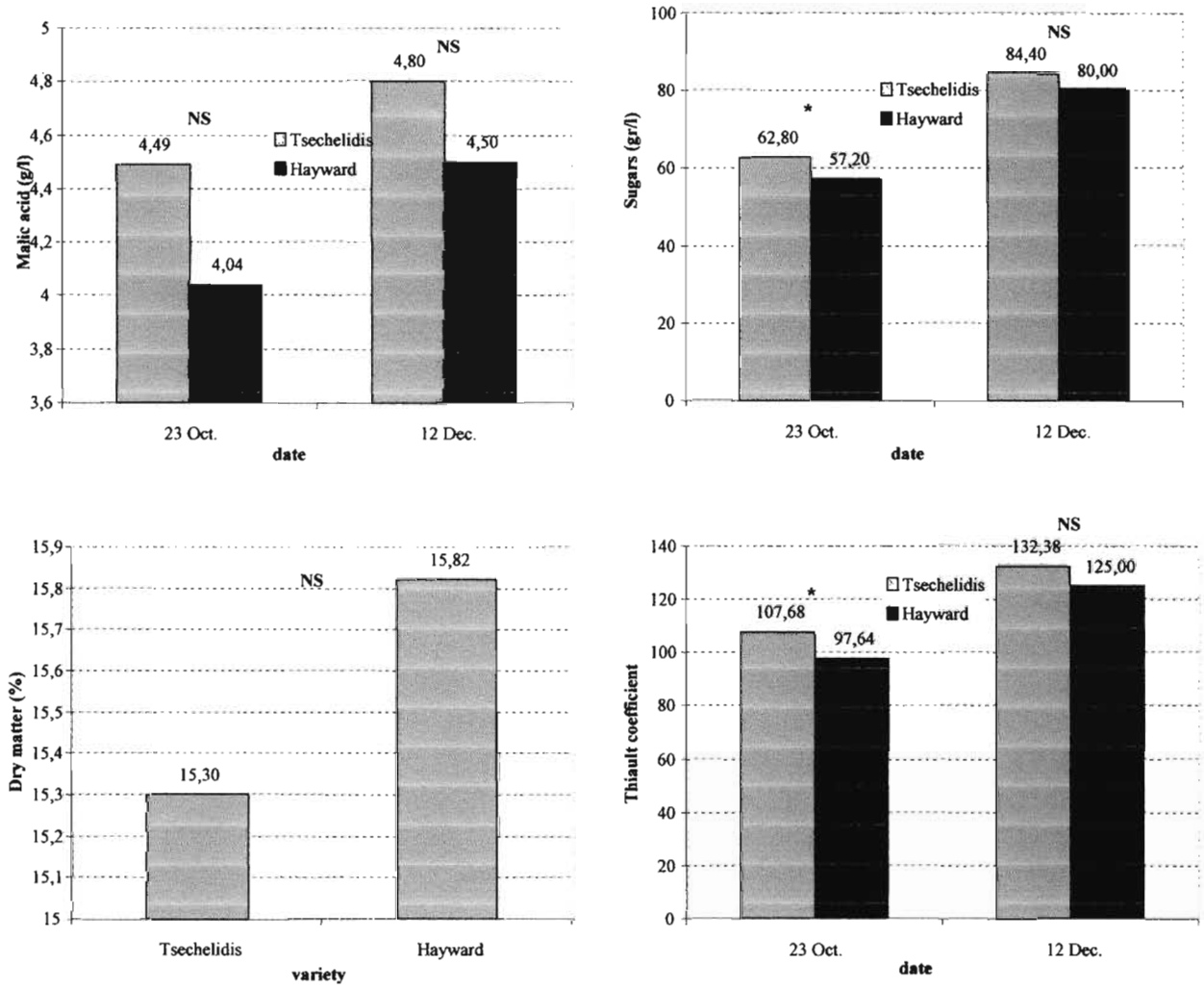

Figure 6. Content of malic acid, sugars, dry matter in the flesh of the 'Tsechelidis' and 'Hayward' actinidia varieties and the Thiault coefficient during the harvest and 2 months later.

Tsechelidis Hayward